FORM PTO-1390 (Modified) (REV 11-98) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER	U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR)
7054-101XX	09/674648

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/DE00/00536	February 23, 2000	March 3, 1999

TITLE OF INVENTION

METHOD FOR PRODUCING A CAMSHAFT AND CAMSHAFT PRODUCED ACCORDING TO SAID METHOD

APPLICANT(S) FOR DO/EO/US

Bodo FURCHHEIM and Hoang LE THIEN

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☐ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
   a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☒ has been transmitted by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ A copy of the International Search Report (PCT/ISA/210).
8. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
   a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☐ have not been made and will not be made.
9. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
10. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
11. ☐ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).

Items 13 to 20 below concern document(s) or information included:

13. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☐ A **FIRST** preliminary amendment.
16. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
17. ☐ A substitute specification.
18. ☐ A change of power of attorney and/or address letter.
19. ☒ Certificate of Mailing by Express Mail
20. ☐ Other items or information:

526 Rec'd PCT/PTO 02 NOV 2000

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
09/674648	PCT/DE00/00536	7054-101XX

21. The following fees are submitted:.

BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :

		CALCULATIONS PTO USE ONLY
☐	Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2) paid to USPTO and International Search Report not prepared by the EPO or JPO	**$1,000.00**
☒	International preliminary examination fee (37 CFR 1.482) not paid to USPTO but Internation Search Report prepared by the EPO or JPO	**$860.00**
☐	International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO	**$710.00**
☐	International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4)	**$690.00**
☐	International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4)	**$100.00**
	ENTER APPROPRIATE BASIC FEE AMOUNT =	**$860.00**
	Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).	**$0.00**

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	
Total claims	30 - 20 =	10	x $18.00	**$180.00**
Independent claims	1 - 3 =	0	x $80.00	**$0.00**
Multiple Dependent Claims **(check if applicable)**.			☒	**$270.00**
	TOTAL OF ABOVE CALCULATIONS =			**$1,310.00**
	Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28) **(check if applicable)**. ☐			**$0.00**
	SUBTOTAL =			**$1,310.00**
	Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (f)). +			**$0.00**
	TOTAL NATIONAL FEE =			**$1,310.00**
	Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) **(check if applicable).** ☐			**$0.00**
	TOTAL FEES ENCLOSED =			**$1,310.00**
				Amount to be: refunded $
				charged $

☐ A check in the amount of to cover the above fees is enclosed.

☒ Please charge my Deposit Account No. **50-0337** in the amount of **$1,310.00** to cover the above fees.
A duplicate copy of this sheet is enclosed.

☒ The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. **50-0337** A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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SIGNATURE

Robert Berliner
NAME

20,121
REGISTRATION NUMBER

November 2, 2000
DATE

SMALL BUSINESS

Applicant or Patentee: Furchheim and Le Thien	Docket #:
Serial or Patent Number:	Examiner:
Filed or Issued:	Art Unit:
For: Method for Producing a Camshaft and Camshaft Produced According to Said Method	

VERIFIED STATEMENT (DECLARATION) BY A SMALL BUSINESS CONCERN CLAIMING SMALL ENTITY STATUS UNDER 37 C.F.R. §§ 1.9(F) AND 1.27(C)

I hereby declare that I am

☐ the owner of the small business concern identified below:

☒ an official of the small business concern empowered to act on behalf of the concern identified below:

Name of Concern: SE Sächsische Elektronenstrahl GmbH
Address: Otto-Schmerbach-Strasse 21a, D-09117 Chemnitz / Germany

I hereby declare that the above identified small business concern qualifies as a small business concern as defined in *13 CFR 121.3-18*, and reproduced in *37 CFR 1.9(d)*, for purposes of paying reduced fees under *section 41(a) and (b) of Title 35, United States Code*, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby declare that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the matter described in:

☒ The specification filed herewith, with the title as listed above.

☐ The patent application identified above.

☐ The PCT international patent application identified above.

☐ The patent number identified above.

If the rights held by the above identified small business concern are not exclusive, each individual, concern or organization having rights to the invention must file separate verified statements averring to their status as small entities, and no rights to the invention are held by any person, other than the inventor, who would not qualify as an independent inventor under *37 CFR 1.9(c)* if that person made the invention, or by any concern who would not qualify as a small business concern under *37 CFR 1.9(d)*, or a nonprofit organization under *37 CFR 1.9(e)*. Each person or organization having any rights in the invention is listed below:

☒ No such person, concern or organization.

☐ Each such person, concern or organization as listed below:

Full Name	☐ Individual
Address	☐ Small Business Concern ☐ Nonprofit Organization

☐ See attached sheet for additional person(s), concern(s) or organization(s).

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate *(37 CFR 1.28(b))*.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine, or imprisonment, or both, under *section 1001 of Title 18 of the United States Code*, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which the verified statement is directed.

Name and Title SE Sächsische Elektronenstrahl GmbH	Date 18. 12. 2000
Address Otto-Schmerbach-Strasse 21a D-09117 Chemnitz / Germany	Signature

A method production of cam shafts and to a cam shaft produced by the method.

The invention relates to a method for the production of cam shafts and to a cam shaft produced by way of said method. It is preferably a question of cam shafts for engines for motor vehicles, although the method is also suitable for the production of similar products such as shafts having cams on them for other applications than engines. Such cams would then be elements for converting rotary movement into a linear one, the linearly moving elements running on cams having different curvatures and able to moved against the direction of rotation.

Cam shafts are known which are produced integrally, that is to say forged or cast. Following a mechanical machining operation, the running faces of the cams, which are subject to wear, are hardened by laser rays, electron beams or WiG remelted or, for example, hardened inductively or in a thermal/chemical process. After there is further machining, for example grinding the bearings and the shape of the cams. These cam shafts suffer from the disadvantage that their weight and accordingly the mass to be moved is extremely high. The great mass of the cam shaft has a disadvantageous effect on fuel consumption. A further disadvantage is the intensive machining for processing the blank.

It is furthermore known to produce cam shafts from a plurality of parts. The individual cams are placed on the shaft and preferably secured thereto by welding, swaging or shrinking. In this respect it is possible to overcome the disadvantage of the substantial weight of solid, integral cams, for the shaft can be a hollow shaft, but production is extremely complex.

In accordance with a further known method the individual cams are secured to hollow shaft by causing expansion of the hollow shaft, with the individual cams slipped onto it, by the action of pressure. As a pressure medium use is preferably made of a liquids. The pressure is supplied by way of a piston or stamp (see German patent publications 3,409,541 and 3,521,206). This method does however suffer from the disadvantage that the production of the individual parts, and more particularly fitting together, is technologically extremely complex and the internal shape of the cams is limited.

It is furthermore known to produce cam shafts by producing an elongated hollow body, that is to say a hollow shaft, by internal pressure forming method (IHU method) so that the material is thrust outward as cams individually, in sequence or simultaneously.

Suitable two-part or four-part tools are employed to feed the hollow shaft in the axial direction to ensure that the cams are produced at predetermined positions and forming in an integral manner takes place (WO 97/46341).

The cam shaft produced by this method does however suffer from the disadvantage that although the costs of manufacture are less than with forged cam shafts or those produced from a plurality of parts, the resistance to wear of the cam faces is unsatisfactory. It is impossible to employ the IHU-method on a sufficiently wear resistant material. It is not possible to produce an even running face on the cams in the case of a small spacing between the cams, as is normally the case with motor vehicle cams, for at the points of maximum forming the material is necessarily weakened, and thus strength is unfavorably affected.

If a material is employed for the hollow shaft, which contributes to reducing such shortcomings, it will admittedly allow adequate forming, but the hardness or, respectively, wear resistance can not be achieved, even with a subsequent hardening step. It is however the hardness and wear resistance of the cams which is a basic requirement for a long working life of a cam shaft in a motor vehicle engine. It is also extremely hard, or even impossible, to achieve the necessary material thickness everywhere in the cam shaft, that is to say the shaft itself and more particularly the flanks and tips of the cams.

It is furthermore known to produce the tube sections constituting the cam face with an eccentric profile and to reinforce it by producing a press fit connection. The production of the cam takes place using explosion forming. The individual cams are secured to the cam shaft with a suitable offset in relation to one another (East German patent publication 234,223). Cam shafts currently produced by the method entail complex manufacture and are heavy. The timing of the plastic forming process is not able to be controlled.

One object of the invention is to provide a method for the production of cam shafts, with which by using the known high internal pressure forming method cam shafts may be produced, which have adequate strength, have low flexure, possess a high resistance to torsion and possess high flexural strength in the loaded faces of on the cam flank and tips or crests. The method of manufacture is to be simple. The application of an additional layer, that is to say an anti-wear layer in a further process step, and furthermore complex later machining is not to be necessary. The amount of material used is to be low. The number of the necessary separate parts for the entire cam shaft is to be reduced in comparison known methods of manufacturing cam shafts.

In accordance with the invention this object is to be attained with the features of claim 1 and 8. Advantageous further features are described in claims 2 through 7 and furthermore claims 9 through 17.

The essence of the invention is that suitably hard and wear-resistance bearer rings with thin walls and having the eventual form of the cam are produced, such bearer rings are inserted in an IHU tool by high internal pressure forming (referred to as IHU) and using the axial forces applied to the tube in combination with internal forces applied by way of a pressure medium a single or double stage forming of the tube takes place to yield the cam shaft.

At the end of the forming process the frictional and interlocking connection of the cam with the bearer ring takes place. At the ends of the cam shaft known bearing elements or journals are arranged and then secured in a known fashion.

In accordance with a further preferred development of the invention in a method step, which precedes the above mentioned method, a tube of a material satisfying the necessary requirements for forming and as regards mechanical properties, is so deformed by the known method of kneading, also known as roll kneading, or swaging, that the tube, completely or partially, or only the cam shaft ends, is plastically formed, that is to say for instance stretched and/or made thicker. At the ends shaped elements for drive and control elements, for instance the seat for gear wheels are produced. In the following the above mentioned method step the IHU method is used to flare out the tube that region, in which the cams are arranged, the IHU tool having been previously had the bearer rings inserted into it in accordance with the positions of the cams.

In the case of cams which have a very sharp curvature there is the disadvantage, when the bearer rings have a constant wall thickness, that the tube is subject to a high degree of deformation and in some cases a multi-stage forming method will be necessary. This leads to an increase in manufacturing costs and a reduction in productivity. Furthermore in the cylinder head there are interfering structures clear of the cam shaft and between or alongside the cams. They mean that the space available is reduced and the IHU process is harder to perform. This limitation is only, if at all to be overcome by the use of a complicated, multi-stage IHU process. This in turn leads to high costs of production. Therefore an advantageous form of the method and, respectively, of the shaft produced in it, is such that the bearer rings, which are produced in a separate method, externally possess the functionally dependent outline and internally have and somewhat greater diameter than the tube. The wall thickness of the bearer ring is not constant and is greater at the cam tip or crest. This means that the bearer ring has, as a cam, a variable thickness and its inner periphery is not a circle.

The method in accordance with the invention is essentially that two or more modern manufacturing methods are combined with each other.

It is an advantage to produce at least one groove radially in the bearer ring in order to prevent displacement of the bearer ring because during the action of pressure such groove becomes filled with material of the shaft.

An other preferred feature of the invention is such that the drive and/or control elements are also secured on the shaft using the IHU method. Furthermore bearing faces may be produced by expansion of the tube using the IHU method as well. The cold solidification or hardening of the tube material owing to the plastic displacement process is particularly advantageous.

The cam shaft produced in accordance with method of the invention is extremely light in weight owing to the hollow cams and very thin walled bearer rings and has a high degree of stiffness. The the advantage that the the bearer rings at the most only have to be machined to a minor extent. Their hardness meeting requirements is already provided, this meaning that later hardening, which is normally necessary, for example inductive hardening or remelting hardening in a vacuum process, can be dispensed with.

Further development of the method leads to the additional advantage that the round kneading or upsetting in combination with the IHU method - unlike the case with all other manufacturing methods - only involves very low manufacturing complexity and consequently low costs. The costs are more especially reduced because the number of individual parts to be separately manufactured and then to be fitted is extremely low. Owing to manufacture in accordance with the invention sources of error are minimized, which so far occurred in the fitting together of parts so far practiced. A substantial advantage of the method is due to the fact that the kneading method renders possible the production of functional elements, which as regards their geometry, dimensional accuracy and surface quality require very little additional machining. Frequently only a grinding process is necessary to finish them.

The cam shaft produced in the method of the invention has a small number of separate parts. At the end of the forming process the cam rings are connected with the shaft frictionally and in an interlocking manner.

It is advantageous as well to provide the bearer ring on the side facing the tube on one or both sides with a chamfer. This furthermore prevent lateral displacement on the shaft.

An advantageous design of the bearer rings is such that the bearer ring, as in the prior art, consists of plastics or sintered materials. Such materials offer the advantage of simple manufacture with low manufacturing costs.

Furthermore ceramic materials may be utilized. They bring the advantage of maximum wear resistance and minimum weight so that very light cam shafts may be produced.

The invention will now be described with reference to two working examples illustrated in the accompanying drawings.

Figure 1 shows a longitudinal section taken through a finished cam shaft.

Figure 2 shows a cross section taken through a cam on the shaft.

Figure 3 shows part in longitudinal section taken through a cam on the shaft.

Figure 4 shows a cam shaft formed by round kneading/upsetting.

Figure 5 shows a cam shaft with bearer rings of non-constant thickness in section.

Figures 1 through 3 show the manufacture of a cam shaft in the IHU method.

By IHU forming in a pressing mold a cam shaft is produced from a thin walled tube 1 of readily deformable material so as to comply with contours, that is to say the positions where a cam is to be seated are deformed outward in accordance with the dimensions of the cam 2 and its position. The shaft with its cam 2 is a single hollow body. In a known process bearer rings 3, as shown in figures 2 and 3, are manufactured. For this purpose a tube of wear-resistant material is so shaped that the eventual form of the bearer ring 3 (cam) is set and the ring is hardened. The prefabricated tube 1, which is to be formed to constitute the cam shaft, is thrust through the bearer rings 3 and together with them placed in the opened forming tool. All individual parts are therefore locked in position. The forming tool is closed axial and the force for forming may be applied. The application of force starts with a predetermined axial force on the tube 1 and/or the tool, supported by a predetermined internal pressure in the tube 1. After completely closing the tool further operations are performed with an orthodox IHU process to connect the tube 1 and the bearer ring 3 by friction and by an interlock. Bearing or drive elements 5 are arranged in a known manner on the end of the tube 1. It is also possible to secure same to the tube 1 using the IHU method as well.

It is furthermore possible to provide a groove 4 in the interior of the bearer ring 3 so that the hold of the cam 2 is improved since the groove becomes filled with the material of the tube 1. It is also possible to provide the bearer ring with chamfers which are filled with material during following IHU method.

The manufacture of a cam shaft by the IHU method in combination with the kneading method will now be described in a further example on the basis of figure 4.

The tube 1 of a readily deformed material is deformed at its ends by round kneading or upsetting to increase its thickness. On one side its internal diameter D_1 is thus reduced and its external diameter D_A is defined so that a zone 6 reinforcing the cam shaft is produced. At the outer end a functional element 7 is produced, whose seat is sized by grinding. At the other end again by kneading or upsetting the internal diameter D_1 of the end already described is reduced simultaneously and a further functional element 7 (bearing seat, cam etc.) is created. In the following method step a collar 8 is produced by upsetting as well which is required for the flank mounting of other components.

After the first method stage the bearer rings 3, produced in a separate process, which correspond to the shape of the cams and the sprocket (not illustrated) are mounted by the IHU method frictionally and with an interlocking effect. For this purpose the bearer rings 3 and the sprocket are placed in the IHU tool.

Figure 5 shows a design of the cam shaft in which the bearer ring 3 has a varying thickness.

The tube 1 of a readily deformable material has an external diameter d_a. The bearer ring 3 of sintered metal has an outer form as dictated by function and internally is not circular. Its internal diameter D_i is somewhat larger than the external diameter d_a of the tube 1. The thickness of the bearer ring 3 is not constant. The height A, which would result if one were to assume a constant thickness of the bearer ring, is larger than the height A` of the maximum displacement of the tube 1 and thus the radius $R_i$ at the deformation of the tube 3 is larger than $R_i$ assuming an equal thickness c` of the bearer ring 3. In this part the thickness c` of the bearer ring 3 is larger and extends into the part with a constant thickness c.

Even although in this form the bearer ring 3 is slightly more expensive, the reduced costs of the IHU method are significant on balance, such method being possible in one step.

Claims

1. A method for the manufacture of a cam shaft form a tube, which is deformed by the action of axial forces and a medium under a high internal pressure, characterized in that the bearer rings, which are produced in a separate method and correspond to the outline of the cams, the desired hardness, strength and resistance to wear, are placed in a high internal pressure forming tool together with the tube to be formed and in that by the action of axial forces and a medium under a high internal pressure the bearer rings are attached by expansion of the tube in a frictional and interlocking manner.

2. The method as set forth in claim 1, characterized in that in a first method step prior to such high internal pressure forming, certain region, preferably ends of the tube, which are clear of the region, in which the cams are seated, are so kneaded and/or upset that same are increased in thickness and/or are stretched and thus different functional elements are formed.

3. The method as set forth in claim 1, characterized in that between the cam shaft ends in the first method step prior to internal high pressure forming bearing faces and the eventual region where the cams are to be seated, are produced round kneading by reducing the diameter in this part to the desired size.

4. The method as set forth in claim 1 or in claim 2, characterized in that between cams bearing faces are produced by internal high pressure forming by expanding the tube.

5. The method as set forth in at least one of the claims 1 through 4, characterized in that the bearer rings are hardened in a known manner prior to being placed in the internal high pressure forming tool.

6. The method as set forth in at least one of the claims 1 through 5, characterized in that a gear wheel or sprocket wheel produced in a separate method is placed in the internal high pressure forming tool and is connected by the internal high pressure forming step frictionally and/or in an interlocking manner.

7. The method as set forth in at least one of the claims 1 through 6, characterized in that after the production of the thickened and/or tapered ends of the cam shaft internal gear teeth and/or a thread is produced by round kneading in an additional method step integrated in an additional method step as part of this method step.

8. A cam shaft produced as set forth in claim 1, characterized in that the cam shaft is so produced from a tube (1) by an internal high pressure forming method that the shaft complies peripherally to have all cams (2) in form and in position in a single piece, that on the formed cams (2) a bearer ring (3), shaped to correspond to the cam periphery and made of a hard, wear-resistant material is secured frictionally and in an interlocking manner, on which

in a known manner bearing elements and/or drive elements and/or control elements (5) are arranged.

9. A cam shaft produced as set forth in claim 8, characterized in that the bearer rings (3) possess the same wall thickness.

10. A cam shaft produced as set forth in claim 8, characterized in that the thickness of the bearer rings (3) is variable, the thickness being greatest near the cam tip.

11. A cam shaft produced as set forth in claim 8, characterized in that the bearer ring (3) is produced of sintered metal, or plastic or ceramic material.

12. A cam shaft produced as set forth in claim 8, characterized in that the tube (3) is produced of aluminum, magnesium or titanium or its alloys.

13. A cam shaft produced as set forth in claim 8, characterized in that the ends of the tube (3) are formed by kneading so that by expansion or tapering the original diameter (D_i; and d_a) of the tube (1) possesses bearing faces, drive and/or control elements and internal and/or external screw threads.

14. A cam shaft produced as set forth in claim 8, characterized in that the drive and control elements, preferably sprocket or gear wheels, are produced by an internal high pressure forming method.

15. A cam shaft produced as set forth in claim 14, characterized in that at least one radially extending groove (4) is produced in the bearer ring (3) and the drive and control elements.

16. A cam shaft produced as set forth in claim 14, characterized in that the side, facing the tube (1) of the bearer ring (3) has chamfers on one or both sides on the side facing the tube (1).

17. A cam shaft produced as set forth in claim 8, characterized in that the bearer ring (3) is hardened prior to application on the formed cams.

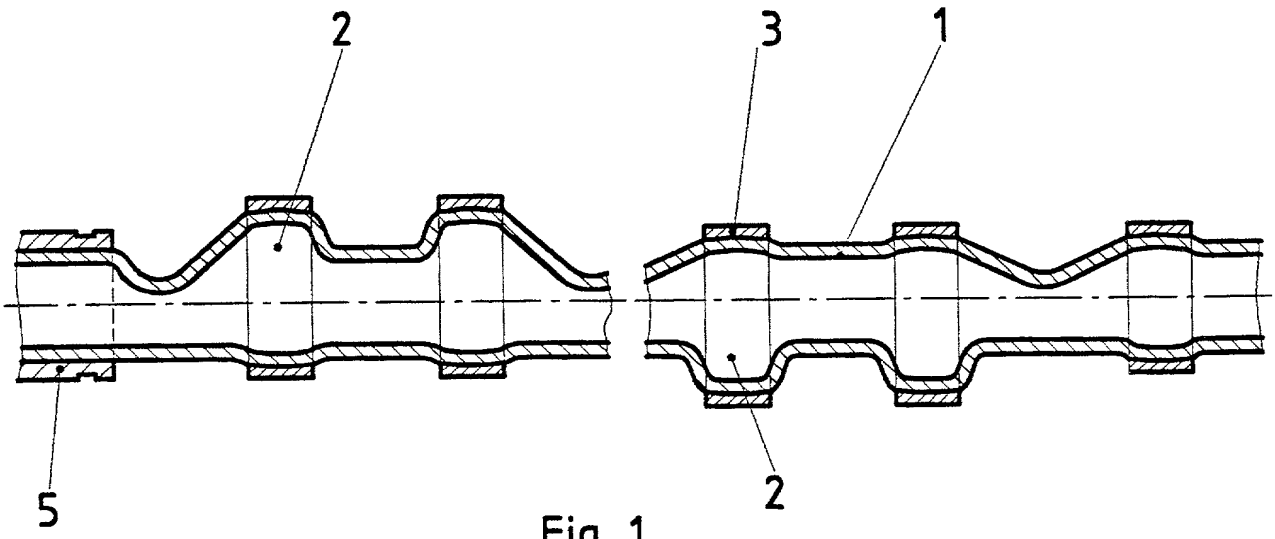

Fig. 1

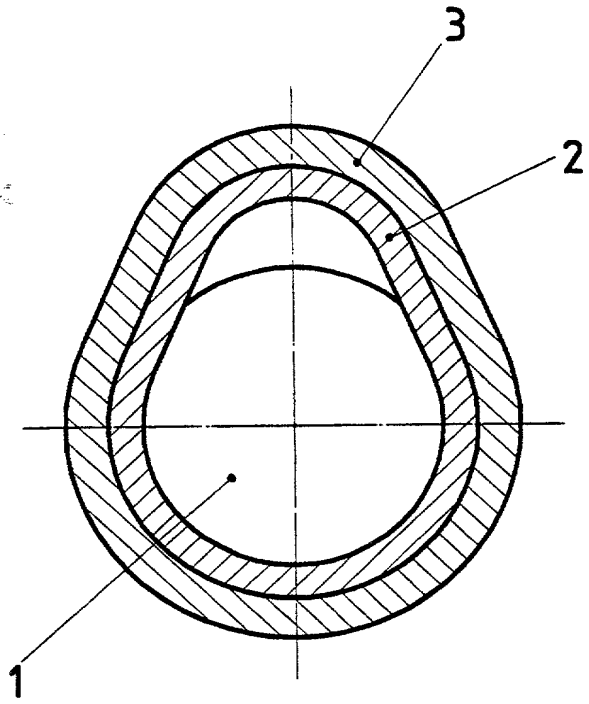

Fig. 2

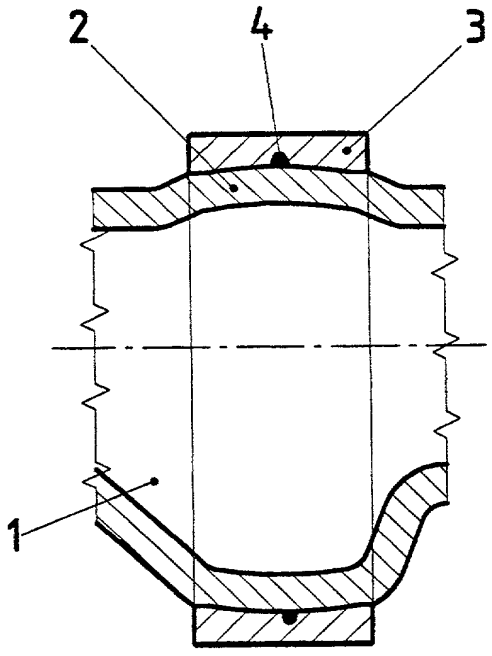

Fig. 3

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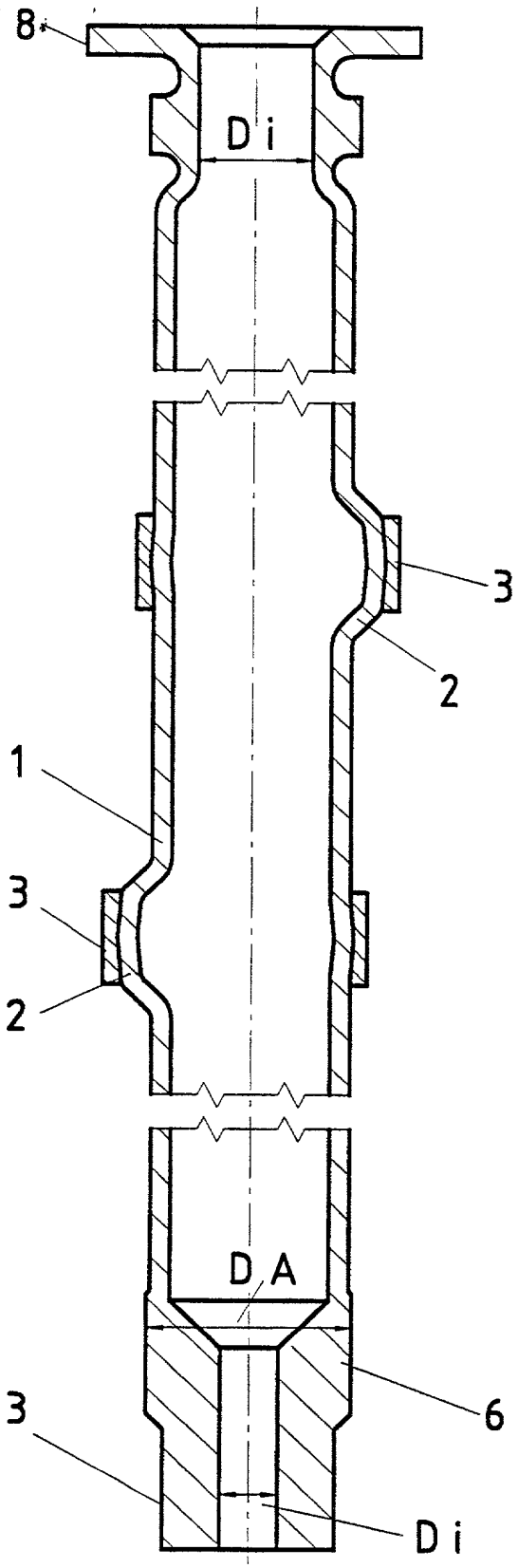

Fig 4

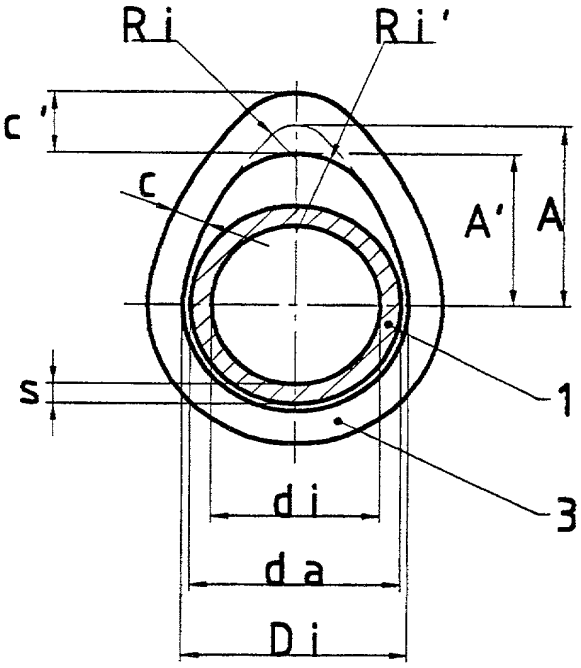

Fig 5

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PTO/SB/01 (12-97)
Approved for use through 9/30/00 OMB 0651-0032
Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION (37 CFR 1.63)

☐ Declaration Submitted with Initial Filing OR ☒ Declaration Submitted after Initial Filing (surcharge (37 CFR 1.16 (e)) required)

Attorney Docket Number	7054-101XX
First Named Inventor	Bodo Furchheim
COMPLETE IF KNOWN	
Application Number	
Filing Date	November 2, 2000
Group Art Unit	
Examiner Name	

As a below named inventor, I hereby declare

My residence, post office address, and citizenship are as stated below next to my name

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

METHOD FOR PRODUCING A CAMSHAFT AND CAMSHAFT PRODUCED ACCORDING TO SAID METHOD

(Title of the Invention)

the specification of which
☐ is attached hereto
OR
☒ was filed on (MM/DD/YYYY) November 2, 2000 as United States Application Number or PCT International Application Number [ ] and was amended on (MM/DD/YYYY) [ ] (if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56.

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached? YES	Certified Copy Attached? NO
PCT/DE00/00536	PCT	February 23, 2000	☐	☐	☒

☐ Additional foreign application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto:

I hereby claim the benefit under 35 U.S.C. 119(e) of any United States provisional application(s) listed below

Application Number(s)	Filing Date (MM/DD/YYYY)

☐ Additional provisional application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

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DECLARATION — Utility or Design Patent Application

I hereby claim the benefit under 35 U.S.C. 120 of any United States application(s), or 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT international application in the manner provided by the first paragraph of 35 U.S.C. 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. Parent Application or PCT Parent Number	Parent Filing Date (MM/DD/YYYY)	Parent Patent Number (if applicable)

☐ Additional U.S. or PCT international application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

As a named inventor, I hereby appoint the following registered practitioner(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

☐ Customer Number [ ] → Place Customer Number Bar Code Label here
OR
☒ Registered practitioner(s) name/registration number listed below

Name	Registration Number	Name	Registration Number
Robert Berliner	20,121	M. John Carson	25,090
Billy A. Robbins	18,313	Margaret A. Churchill	39,944
John M. May	26,200	Terri L. Sale	45,066
Abraham N. Seidman	41,300		

☐ Additional registered practitioner(s) named on supplemental Registered Practitioner Information sheet PTO/SB/02C attached hereto.

Direct all correspondence to: ☐ Customer Number or Bar Code Label [ ] OR ☒ Correspondence address below

Name	Robert Berliner, Esq.				
Address	FULBRIGHT & JAWORSKI L.L.P.				
Address	865 South Figueroa Street, 29th Floor				
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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Name of Sole or First Inventor: ☐ A petition has been filed for this unsigned inventor

Given Name (first and middle [if any])	Family Name or Surname
Bodo	FURCHHEIM

Inventor's Signature	Bodo F.					Date	18.12.00
Residence: City	Chemnitz	State		Country	DE	Citizenship	DE
Post Office Address	Otto-Thorner-Strasse 53						
Post Office Address	D-09127						
City	Chemnitz	State		ZIP		Country	DE

☒ Additional inventors are being named on the 1 supplemental Additional Inventor(s) sheet(s) PTO/SB/02A attached hereto

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DECLARATION

ADDITIONAL INVENTOR(S) Supplemental Sheet
Page 1 of 1

Name of Additional Joint Inventor, if any:	☐ A petition has been filed for this unsigned inventor						
Given Name (first and middle [if any])			Family Name or Surname				
Hoang			LE THIEN				
Inventor's Signature	Hoang Le Thien					Date	18.12.00
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City	Limbach-Oberfrohna	State		ZIP		Country	DE

Name of Additional Joint Inventor, if any:	☐ A petition has been filed for this unsigned inventor						
Given Name (first and middle [if any])			Family Name or Surname				
Inventor's Signature						Date	
Residence: City		State		Country		Citizenship	
Post Office Address							
Post Office Address							
City		State		ZIP		Country	

Name of Additional Joint Inventor, if any:	☐ A petition has been filed for this unsigned inventor						
Given Name (first and middle [if any])			Family Name or Surname				
Inventor's Signature						Date	
Residence: City		State		Country		Citizenship	
Post Office Address							
Post Office Address							
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